

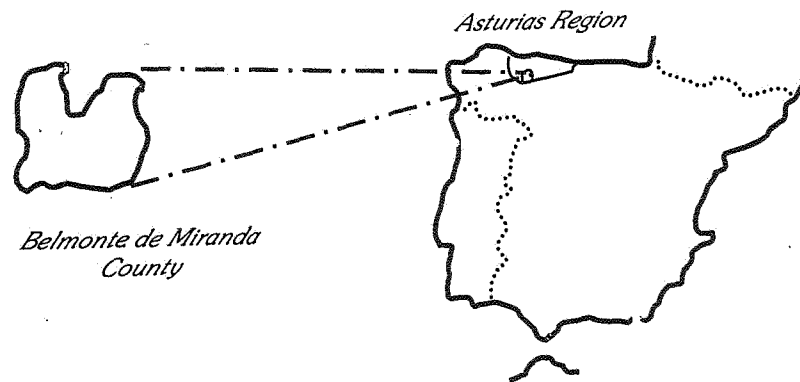
KEEPING MOUNTAIN PASTURES IN A GLOBAL ECONOMY CONTEXT: ECOLOGICAL AND POLITICAL ISSUES

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Some relevant features of mountain pastures

The mountain areas show in the European context a set of common and relatively distinctive characteristics that lead them to share, in spite of the diversity among countries, a quite similar natural and social context. In a continent characterised by high population density, and by an intensive exploitation (and practically millennial) of natural resources, the mountain areas emerge as islands that conserve a relevant part of their natural and cultural attractiveness. As a contrast, the lowlands that surround them are in a quick process of change, associated to the economic development within an economy more and more globalised. In a certain way, it seems that the mountain areas are separated from the external situation, locked in their own world. Nevertheless, the mountain is not and it has never been unplugged from the external reality, and the European mountain areas face serious social, natural and economic problems that can radically change their physiognomy in the next decades. The mountain grasslands exemplify this situation clearly, and they will be used in this paper (i) to show the complexity of the relationships among the social and natural issues involved in the management of the ecosystems, and (ii) to discuss some instruments of potential application for the conservation of the European cultural landscapes. In order to clarify the problem, an example from the Spanish mountain (the County of Belmonte of Miranda in Asturias, figure 1) will be used as a representative of the situation of many regions of Southern and Central Europe.

Figure 1. Location of the Belmonte de Miranda County in the Iberian Peninsula.



The mountain areas are outstanding among the areas of higher natural value in Europe, as it is reflected in the spatial distribution of nature protection sites. Although the attraction that mountain landscapes have to man may have played a role in these declarations, it is undeniable that mountains harbour good part of the most valuable elements of the European flora and fauna, as well as some of the less altered ecosystems. The combination of a relatively reduced human pressure with the ecological and biogeographical conditions of the mountains provide a good basis for the conservation of these valuable habitats. Concerning this particular habitat, part of the Belmonte County has been included in the Somiedo Natural Park, where the biggest population of brown bear (*Ursus arctos*) in Spain survives.

The low population density of mountain areas is possibly the most characteristic element of these spaces from the social point of view. The difficulties of life conditions in mountains and the shortage of resources, historically limited the population density of the mountain regions. Recent population and economic growth has mainly taken place in more populated areas, with less abrupt topography and better communications. As it is shown in table 1, the population density of Belmonte County is hardly 10.6 inhabitants for a square kilometre, in comparison with a density of approximately 80 inh./km² for the whole area of Spain. In fact, the population density of the Asturias Region is 102.6 inh./km², in spite of the fact that approximately one third of its territory is occupied by mountains.

The main economic activity of these areas is agrarian and its development is very restricted by the physical characteristics of the territory. On one hand, the vegetative period is reduced even at valley bottoms (hardly 6 and a half months in this case), seriously limiting the possibility for cropping. On the other hand, certain areas do not allow any form of exploitation due to steep landscape, altitude or skeletal soils. The main land use types are forestry and livestock grazing. The lands located above the timberline and almost all productive lands down the valleys are occupied by grasslands. Livestock depends very tightly on them and they are the basis of the economy of villages, as we will see.

Table 1. Main geographical features of the Belmonte de Miranda County (Asturias, Spain). Abbreviations: UAA, Utilised Agricultural Area; LU, Livestock Unit.

Geographical data from Belmonte County	
Population density	10,6 inh./sq.km.
Surface	100,471 ha
Land use types	
- % UAA	37,3 % surface
- % forest	12,6 % surface
- % unproductive	42,4 % surface
Grasslands	99,3 % UAA
Livestock density	0,20 LU/ha UAA
Livestock - valley grasslands	2,15 LU/ha mown grassland
Vegetative period (in valley)	194 days

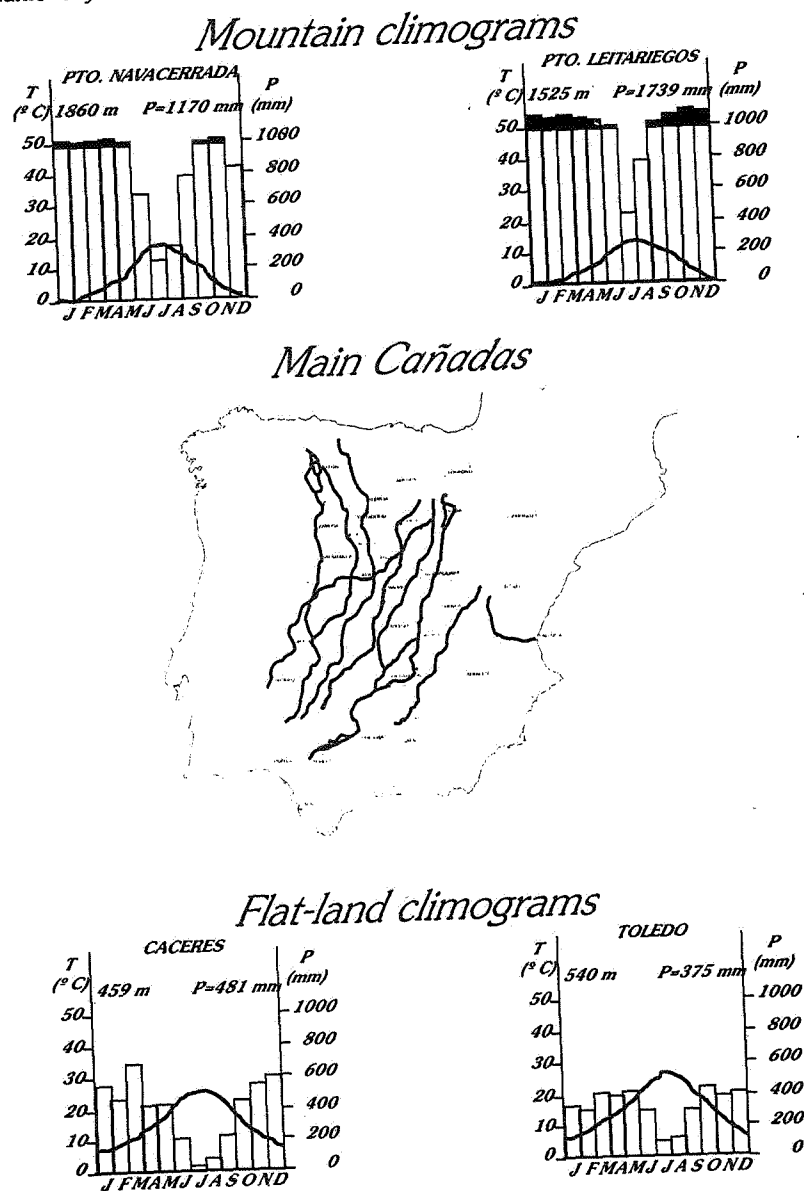
Tourism has added to this traditional activity in the last decades, and it has a role in the economy of many mountain areas. The mountain landscapes have traditionally attracted the inhabitants of other areas that enjoyed the landscapes in summer as well as the relatively mild climate during this time of the year. This tendency has been reinforced in the last decades with the widespread increase of purchase power, the valuation of the free time and with the growth of activities in close contact with nature. The conservation of traditional ways of life in the mountain areas provide an important added value to those of wild landscapes, traditionally looked for by tourists. Tourism in mountain areas has been promoted as means of diversifying economic activity, and it is still included in most development initiatives for these areas.

Two key factors to understand mountain pasture dynamics

Two fundamental questions to understand the problems that face the pastures of Mediterranean mountains are: (i) their traditional use by livestock coming from areas more or less distant, and (ii) the long history of interaction of these grasslands with livestock. Thus, mountain landscapes as we know them are, in fact, partially a reflection of the human alteration of the original conditions.

Mountain areas have traditionally functioned in harmony with the lowlands. Traditional land use took advantage of the complementary nature of both habitat types and established ways of exploitation supported upon the comparative advantages. In this respect, their climatic conditions provide a special value in the Mediterranean regions subjected to a strong summer drought (figure 2). The localities in the big valleys of the Iberian Peninsula are subjected to a Mediterranean climate characterised by a strong summer drought that leads to a biological rest of 3-4 months. During this period, the food for livestock is scarce, and external resources are necessary to maintain the animals. In contrast, the mountain areas hardly suffer the summer drought (figure 2) and due to the day length and to the mild temperatures, they present the peaks of maximum grass production in this season.

Figure 2. Climograms corresponding to two mountain grassland locations and two towns in the central Iberian plateau. The lines in the map show the main 'cañadas' traditionally used for the migration of livestock to summer mountain grasslands.



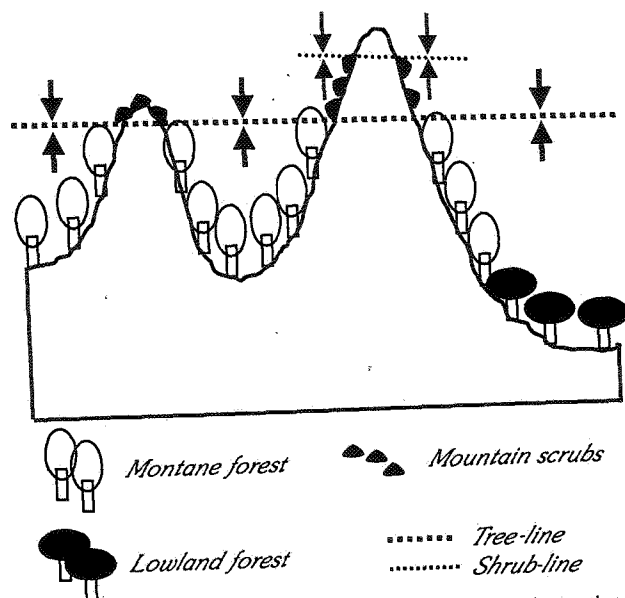
The pastoral cultures of the Mediterranean have taken advantage from this biological fact in the last millennia, directing big seasonal migrations of livestock flocks ('trashumancia') from the lowlands towards the mountain areas. In the Iberian Peninsula this seasonal migration of livestock drove to the birth of the 'cañadas', an extensive net of paths that crosses the territory from north to south (figure 2). Traditionally, thousands of livestock heads moved to the mountain areas to pass the summertime, and the shepherds in care of the flocks then settled temporarily in the towns of the mountain. In other occasions, as it happened in the area of Belmonte, they temporally lived in small settlements located in alpine grasslands. These settlements (denominated 'brañas' in the area) were occupied for only a few months a year by the moving shepherds and by a few locals and the remnants of which represent a great cultural, ethnographic and aesthetic value for their peculiar architecture.

The presence of the flocks from the plains in the mountains during the summer provided multiple benefits to the inhabitants of these areas. Mountain grasslands are not a limiting factor for the farmers of the valleys, since the restrictive factor is the quantity of valley grasslands available (table 1). The density of livestock of the Belmonte County is very low relative to grasslands (hardly 0.2 LU/ha), but the local farmers cannot increase the number of animals since they are limited by the food available in winter. The feeding of the livestock in winter is sustained on the hay harvested in summer, and on the open grazing in mild periods on grasslands located in the valley bottom. Due to the area ratio between valley and mountain grasslands, the livestock in the valleys (something more than 2 LU/ha of harvest pasture in this case) is unable to utilise the grass production of the mountain pastures in summer. Therefore, the use of the high-altitude pastures by livestock coming from other areas does not compete with the interest of local livestock.

Also, since the mountain grasslands are of common property, the revenues obtained from the payment of the grazing rights revert directly to local economy. The inhabitants of the mountain valleys have been historically compensated by this way for the use of their grasslands by the rangers from the lowlands. Complementarily, the population residing temporarily in the district provides extra revenues in the area as a direct consequence of the consumption of basic products.

A second key element for the understanding of the problems that face mountain pastures is that of its semi-natural nature and its dependence on grazing. Phytogeography describes the vegetation of the mountains by zones of characteristic formations which are limited in altitude by climatic conditions, as it is shown in the example of figure 3. Areas typically used for grazing in the high mountain correspond to the cushion-like scrubs and the grasslands located above the forest limit. These vegetation zones are described as stable entities, however, their dynamic character can be recognised as shift of forest borders in the mountains, coinciding with changes of global climatic conditions. The altitudinal limits of forests and high-mountain scrubs are therefore dynamic and are determined by the current conditions.

Figure 3. The dynamic nature of the altitudinal limit of the timberline and the semi-natural origin of mountain pastures. The phytogeographic view of mountain plant communities is complemented in this figure with a schematic representation of the possibility for tree- and scrub-limits to move up and down depending on the environmental conditions at any time.



In this context, the effect of grazing has a prominent role in the maintenance of the balance between woodlands, scrubs and grasslands. Climatic conditions would allow the survival of scrubs and forests at higher altitudes than those found at the moment, but herbivore grazing blocks succession by impeding effective colonisation of trees and shrubs.

Current limits of mountain grasslands are not sharp and respond to the combination of the climatic conditions and livestock grazing intensity. We should therefore understand that mountain landscapes, in spite of their apparent naturalness, are partly the product of human activity and livestock grazing.

Another issue is related to the effect of grazing on different plant species, and to the characteristics of different herbivores. Although it is frequently assumed that different livestock species are similar, and equivalencies among them have been established in direct relation to their corporal weight (for example the 'Livestock Unit'), the reality is very different.

Herbivores use the landscape and select their diet in a way determined by their physiological characteristics that have been synthesised in a gradient from 'rough grazers' to 'selectors'. On one hand, herbivores specialised in the ingestion of big volumes of low-quality forage ('rough grazers') take advantage of the great capacity

of rumen to work as big fermentors of forage with low nutritive value. In general, they are relatively big animals, with low capacity to select their food and an unspecialised diet, as the cow.

At the opposite end are the 'selectors', mostly of smaller size, whose diet is centred to the most nutritious parts of plants (young sprouts, flowers, fruits) that are usually strongly protected by different toxic products. These species need a gape morphology that allows them to select small very nutritious bouts, and a potent mechanism for the detoxification of the ingested food, but they don't need a very big rumen neither a very long intestine. Among livestock species, the goat is a very selective browser.

This differentiation has important implications for the vegetation of the grazed areas, since the resulting vegetation will be dependent on the involved herbivore species, and not only on their quantity. As it will be seen later, the evolution of mountain landscapes has been much influenced by this fact in the last decades.

Mountain communities and grazing

Although it is true that the current state of the mountain grasslands is closely associated with its traditional ranging use, it is even more dependent on the socio-economic situation. The whole economy is sustained by cattle production, which results in the vulnerability of the system.

The mountain areas show a high economic dependence regarding the production of the agrarian sector in a European context. In the County of Belmonte (table 2), 44 % of the employment is associated to agriculture, in comparison with only 11 % in the Autonomous Region of Asturias. This percentage makes farming the prevailing activity in the area in terms of employment, followed at a distance by construction, trade and hostelry. Also, the dependence of farmers from their production is very high, as it is shown by the fact that 66 % of the interviewed farmers in a poll (50 farms) had their cattle exploitation as the only source of revenues, and that for almost 90% of them it was the main economic activity. Unlike in other areas, it is very unusual to find only partial dependence on the agrarian sector. Obviously, this fact increases the fragility of the system facing any external changes, and it hinders the population's reorientation towards other activities.

The main agrarian activity of the mountain areas is livestock breeding for meat production, while almost all cultivation made some decades ago on valley bottoms has been abandoned. At present, the most productive soils are devoted to grasslands for livestock breeding, mainly to cattle raising for meat production, and to a lesser extent for horses (table 2). The production of milk is now very marginal in the studied county, due to the milk quotas, the difficulty of transport, the necessity of feed supplement for dairy cows and the impossibility to use the high-altitude grasslands in dairy farming. This has led to the exploitation of meat cows in a traditional way together with some horses, due to the ease of their breeding as well.

Table 2. Main socio-economic features of the Belmonte de Miranda County (Asturias, Spain). Data from the Instituto Nacional de Estadística and from a poll to 50 farms.

<i>Socio-economic features of Belmonte County</i>	
Primary sector labour	44 % (Asturias: 11%)
Dependence on farming activity	
- >50%	89 %
- 100%	66 %
Farm size	
- <20 ha	53 %
- <50 ha	92 %
Flock size	
- mean	<10 LU
- farms with 10-50 LU	65 %
Livestock	
- cattle (98% farms)	83,1 % LU
- horses (80% ")	14,1 % LU
- sheep (17% ")	1,3 % LU
- goats (13% ")	1,5 % LU
Income of farms*	
- <30 000 Euro (~2,5 GDP/p)	66 %
Workforce	
- farms with ≥2 workers	82 %
Dependence on subsidies	
- >10%	>90 %
- >40%	~35 %
Population	
- over 65 years	29 % (Asturias: 17%)

* Gross income obtained by selling farm products.

GDP/p, mean Gross Domestic Product by person in Spain.

Most of the farms are of small size and their profitability is very low (table 2). More than half of the farms have less than 20 animals and the maximum does not reach 50 animals. Thus, most farms are in the 10-50 LU range, while there are a great number of very small farms so the mean flock size of the district is somewhat less than 10 LU/farm. With this farm size, and keeping in mind that most of the farms occupy about 2 people (typically a couple, two brothers etc.), it can be generalised that the revenues generated by the farms are very low. The revenues (before expenses and taxes) declared by the farms are about 2.5 times less than the mean GDP of Spain.

This situation generates a great economic uncertainty and it threatens the maintenance of cattle raising in the area. The economic structure of the farms, together with their dependence on subsidies (superior to 10 % in most cases and even near to 40 % in many cases), progressively lead the young generations to abandon the area and work in other sectors with better perspectives. This fact hinders even more the resurgence of mountain cattle raising, since there is no capitalisation, the young population has no incentives for the introduction of changes that could revert the situation.

The problem of abandonment

All this results in a widespread abandonment of rough grazing, the effects of which on the vegetation are evident in many mountain grasslands (figure 4). The problems of abandonment associate firstly with the decrease in the number of animals that graze the pastures, both coming from the vicinities but especially those from distant areas. Although the number of animals has not diminished very much in the villages of the mountain areas, what has fallen drastically is the number of flocks of seasonal migration. The wages of the shepherds and the low price of fodder have resulted in the cessation of this traditional activity. As a consequence, mountain pastures currently support a grazing load much lighter than traditionally and the probability of reverse for this situation is minimal.

Figure 4. Shrub encroachment is obvious in many mountain pasture areas, like the 'braña' in Belmonte County of the picture. The dashed line shows the approximate extent of scrubs at present, and the arrows point the direction of advance over the grassland.



A change in grazing species can also be observed. The majority of the livestock that moves to the mountain pastures at present is cattle, and in smaller amount horses. Conversely, the proportion of sheep and goats that graze in the mountains has diminished drastically. Since the cows and the horses are specialised in the ingestion of rough grass, the change of the livestock type has contributed to the development of woody species. Sheep as well as the goats are more selective grazers and they exercise a more effective control of woody species than cows and horses.

The decrease in the grazing pressure together with the diminution of browsing by selective species has resulted in the development of scrubs in the pastures during the last decades. It is frequent to find scrub patches with round forms and advancing fronts towards the pastures. So, mountain pastures become more and more restricted to the flat central parts of the small valleys located above the timberline. Pasture loss has an importance from the conservation point of view for several reasons, like the increase in the frequency and extension of fires, and the loss of the landscape values characteristic for mountain areas.

Some political issues

The local problems of social, economic and ecological nature are even enhanced by the new global political tendencies, however, some potential solutions can be outlined.

The economic globalisation and the international agreements for the liberalisation of trade can threaten the survival of a substantial part of the European cattle farms and especially those of small dimension and poorly equipped. The agreements of the GATT and other later international regulations lead to an imbalance of European cattle economy. On the one hand, they seek to open up the markets to the international competition that would reduce European market prices down to levels outcompeting local production. On the other hand, regulations are more and more against the policy of subsidies provided by the European Union. This could end in such a loss of revenues of farmers that in cases like the one under study, it could lead to definitive abandonment.

The situation described above predicts that large mountain areas in the European Union will become uninhabited as a consequence of the cessation of its main economic activity. This would mean a serious loss of social and cultural values at a European level. At the long run, the environmental costs of abandonment can be relatively high and will be reflected in economic costs, such as the case of fire prevention policies and that of conservation management of habitats and species protected by the European legislation. Parallel, tourism could diminish greatly because of the loss of traditional landscapes, since tourists look for the remnants of the local cultural heritage.

Nevertheless, three issues can facilitate the maintenance of these pastures with their traditional activity. In the first place, tourism can serve as a supplementary source of income for the mountain population that may support traditional activities as well.

In the second place, the Common Agrarian Policy has launched a series of subsidies for environmentally friendly agriculture and ranching activities. These subsidies are not aimed at the increase of production but to maintain environmentally-sensitive

systems. So, the farmers receive a payment for the benefits they provide to the society through the conservation of the territory. Such a support type has been started in the County of Belmonte, summarised in table 3.

Table 3. Main characteristics of the agri-environmental programmes implemented in the Belmonte de Miranda County.

<i>Agri-environmental measures for grassland maintenance in Belmonte de Miranda</i>	
<i>Keeping summer grazing</i>	
- targeted to farmers	
- June to August grazing of common pastures	
- stocking densities of 0,3-1,4 LU/ha	
- no use of biocides in pastures	
- payment:	61 Euro/LU
	106 Euro/LU in Natural Park
- high acceptance (except dairy farmers and retired farmers)	
- average payment:	1 026 Euro/farm
	(mostly <20% of income)
<i>Shrub clearing</i>	
- targeted to municipalities	
- expenses of shrub clearance (181-239 Euro/ha)	
- pastures with $\geq 15\%$ shrub cover	
- stocking density of ≥ 0.6 LU/ha	
<i>Shepherd contracts</i>	
- targeted to farmers	
- subsidy of 91 ECU/LU	
- maximum 3,636 Euro/contract	

Basically, these payments compensate farmers for lower income in case of good farming practices. Three types of subsidy exist, the main one is dedicated to traditional husbandry: livestock has to graze at high-altitude pastures during the whole summer, instead of passing part of the time in stables. Another type focuses on the elimination of scrubs developed on mountain pastures, and a third one is dedicated to contracting shepherds to take care of the livestock during its stay in the mountain. The reason of the last type of subsidy is to avoid the losses caused by bears and wolves, since the animals are exposed to the attack by carnivores (the State compensates farmers). This is one reason that justifies the maintenance of agricultural subsidies despite of international agreements.

The last fact that can help the maintenance of mountain cattle raising and this way the preservation of mountain pastures is related to the quality labelling of food products. A system of meat labelling will be launched in Europe that requires detailed information on the origin, feeding habits etc. of animals and it will be compulsory to all pieces of meat for sale. This system can be beneficial to extensive ranching, as consumers are ready to pay more for natural, reliable products. The current concern at European level for mad cow disease (BSE) indicates that these products can have a better market in the future, and such preferences may indirectly contribute to the conservation of mountain landscapes. Nevertheless, the maintenance of mountain pastures faces serious problems the solution of which needs time and a decided action.

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